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The Significance of IODINE in the Feeding of Livestock

By

GEORGE B. ROTHWELL, B.S.A.

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"THE Significance of Iodine in the Feeding of Livestock" has been prepared and written by George B. Rothwell, Dominion Animal Husbandman of the Experimental Farms System in Canada. Mr. Rothwell is outstanding as an investigator and authority on livestock problems and this article of his is most timely. It summarizes the work and findings in connection with the feeding of Iodine to Livestock as carried on by Experimental Farms throughout the Dominion.

The Significance of Iodine in the Feeding of Live Stock

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In the much discussed field of live stock mineral requirements and deficiencies, there is one constituent, more recently in the limelight, as yet imperfectly understood in its action by the scientist, and not sufficiently appreciated by the stockman,—iodine. Most of us are familiar with the therapeutic or medicinal value of tincture of iodine, iodoform, Lugol's solution of iodine, etc. Most of us are familiar with the potassium iodide treatment for goitre in human beings and with the fact that such goitre is more frequently found in iodine deficient areas. Not all are familiar with the fact that, while only the most minute traces of iodine are required for proper animal functionings, even partial interference with or diminution of this requirement or reserve, may be reflected in most undesirable conditions, quite apart from goitre. Here the road between cause and effect is frequently so long and indirect as to prove difficult of travel. Just how far reaching is the effect of iodine deficiencies or excesses on the nutrition and proper functioning of live stock is not known at present. Speaking strictly as a practical stock man and admitting a relatively superficial knowledge of animal physiology and pathology, it would seem to the writer that in this element we have, not a panacea in any sense, but an agent, firstly, with preventive, and secondly, with curative properties that make its consideration well worth while.

Certain general facts concerning the use of iodine with live stock that have come to the writer's attention from trial and experiment, and from the findings of scientists and research workers, are as follows:

* * * *

1. That there are marked iodine deficient areas throughout Canada.
2. That the administration of iodine with certain kinds of stock apparently has desirable influences even where iodine deficiency, as generally recognized, does not appear to exist.
3. That the source of iodine as it may be administered to live stock is immaterial (see note) and the choice governed rather by economy of purchase and ease of administration.

4. That what may be termed the optimum (or best all round) quantities of iodine for definite uses with the different kinds of stock have not been definitely ascertained as yet. So small may these quantities be as to seem ridiculous. In many cases of deficiency, the tiniest quantities supplied regularly produce remarkable results.

5. That while the curative qualities of iodine in its various forms are well known to the stockman, the prophylactic (or protective) properties are equally as important, and, up to the present, less recognized.

6. That iodine, particularly where there is a deficiency, produces its most potent results, as so far disclosed, where administered in small quantities regularly to the female *during the period of pregnancy.*

7. That the method of administration is even more immaterial than the source, provided the animal body absorbs it *regularly and in accordance with its minute requirements.*

NOTE:—Iodine, of course, is found in certain toxic combinations. These are not commonly available. It is conveniently available where used as an accessory to the normal iodine content of the ration, as potassium iodide (the most commonly used form), tincture of iodine, Lugol's solution of iodine, etc.

* * * *

The Practical Application. Let it be emphasized once more that iodine is no cure-all. From the foregoing generalities such might be inferred. After reading this preamble, the following paragraphs concerning the known powers of iodine in a protective sense mainly, may prove of interest.

First, a consideration of the practical forms of iodine administration:

1. Potassium iodide as relating to this discussion is by far the more generally used of all forms of iodine.

2. Commerical salt, either in the block or fine form, may be purchased. This, in general, is said to contain in the vicinity of .02 per cent potassium iodide crystals, or double the quantity found in the iodized table salt now commonly in use for human consumption.

3. Potassium iodide crystals may be purchased at any druggists, supply houses, or certain of the live stock co-operative associations and prepared at home for administration,

(a) by mixing it with salt, preferably fine; (b) by diluting definite quantities of potassium iodide with definite quantities of water, thus making what is known as a stock solution, and mixing small quantities of this with feed daily, or at regular intervals; (c) by diluting small quantities with drinking water at stated regular intervals. Certain of the above methods are particularly suited to each of the different classes of stock from the standpoint of practicability of administration.

* * * *

With Sheep. Iodine administered to the pregnant ewe will definitely control goitre in lambs, where such abnormality exists, notably in known iodine deficient areas. Apparently it has a marked but not so thoroughly proven effect on falling or loose wool. Apparently, too, it has a most beneficial effect where for no distinct reason weak lambs, over-grown, flabby lambs or premature births are common.

Method of Administration. In the form of an iodized salt. Where such is used the year 'round, it is quite likely that a commercial iodized salt will be effective. Where an iodized salt is used during the period of pregnancy only, results secured on certain of the Experimental Farms would make it appear doubtful as to whether .02 per cent potassium iodide (as in commercial salt) is sufficient. On the Experimental Farm System, where experimental work has been carried on in this connection for a number of years, the following practice is followed—dry 100 pounds fine commercial salt; spread it thinly and evenly on a canvas or tarpaulin; dilute from 2 to 4 ounces of potassium iodide crystals in a pint or so of water; sprinkle or spray this solution evenly over the layer of dry salt, which will take up the liquid; mix thoroughly; keep dry and place before the ewes during the winter. It is not definitely known whether these quantities (2 to 4 ounces) are optimum. It has been shown that four ounces is effective under a variety of conditions, although likely in excess for general use. It has been shown in one instance that one ounce per hundred pounds is not fully effective in controlling goitre. On the other hand, one pound of potassium iodide to one hundred pounds of salt has been used with sheep without toxic effect. This was done for comparative experimental evidence, the iodide was greatly in excess of requirement, the mixture therefore very expensive and its use exposed the ewes to unnecessary danger. Possibly the happy medium of three ounces per hundred pounds of salt would be generally effective, although likely in excess of any actual requirement. Anyway, it is safe, reliable and effective. It will be seen, however, that there is a considerable range between the iodine content of commercial iodized salt (.02 per cent) and the home mixture recommended (from .125 to .25 per cent).

It is true that Hanzlik, Talbot and Gibson, in the Archives of Internal Medicine (Vol. 42, No. 4, Oct., 1928) state that "the objections which have been raised against the prolonged administration of iodine in small doses are conspicuously unsupported by trustworthy evidence." The results of their own experiments on rats given the relatively heavy dose of 1 milligram of iodide per head per day, for periods varying between one-seventh and seven-twelfths of the span of life, indicated that such treatment was not merely not detrimental but on the contrary was beneficial along various lines. The writer is informed, also, that at the Rowatt Research Institute in Aberdeen, in recent experiments designed to gauge the tolerance of various animals for iodine, increasing doses were fed for several months (three to seven) until pigs were getting the enormous quantity of 5 grams, calves 4, sheep .3, and poultry .3 grams of iodine per head per day without showing any toxic effects. Nevertheless in some cases there may be danger in materially increasing the quantities here suggested for regular or prolonged use, and for purposes of economy, if no other, the potassium iodide should be kept down as close to the effective point as possible.

* * * *

For Swine. Swine are subject to certain conditions that would seem to be controlled through the administration of potassium iodide to the pregnant sow.

The occurrence of hairless litters is a phenomenon familiar to swine breeders generally. Although partly caused, it is probable, by defective feeding and management of the sow during pregnancy, the primary cause has been well indicated as due to a deficiency of iodine. The most familiar result is hairless litters, although blind pigs, flabby, soft, overgrown individuals and other abnormal manifestations may be present.

The phenomenon of hairless litters is baffling in that it may occur without warning. With conditions normal last year, this year's litters under apparently identical conditions may be seriously affected. Why? No reason can be advanced other than that there is known to be a comparatively wide variation in the mineral content of crops from year to year. In districts recognized as deficient in iodine, hairless litters are common, reaching the proportions of an epidemic in certain years. Where hairless litters are apprehended, and where there is a frequent occurrence of this trouble, the use of potassium iodide is a reliable preventive. In that this condition may not occur regularly year to year, it is difficult to ascertain whether the desired result is due to the treatment. However, where other factors are similar and experimental methods applied, sows fed with protective intent give normal litters, whereas untreated sows show affected or partially affected litters.

As the treatment is simple, comparatively cheap and reliably effective, it should be administered as a routine practice wherever the trouble is common. It consists of the following:—dissolve one ounce of iodide of potassium in two quarts of water. Give one tablespoonful (or half a fluid ounce) of this solution once a day mixed in the feed or water of every six females of the smaller breeds, ewes and sows. A larger dose should be given to cows, one or two teaspoonfuls of the above solution to each animal according to its size. Treatment should begin soon after breeding and continue until the young are born.

Litters from sows so fed (where other items of management have been properly taken care of) are almost invariably strong and vigorous. Although apparently definite results have been obtained by certain American investigators, in the way of increased gains in the feeding of market pigs, attributed to the administration of minute quantities of potassium iodide, these results have not been borne out so far in tests conducted on the Experimental Farms.

* * * *

For Horses. Every farmer horse-breeder is familiar with joint ill, navel ill (pyremic arthritis) of foals. To all intents and purposes it is incurable. Vaccine treatments have been recommended and are fairly reliable, depending apparently on the origin and history of the vaccine. *The disease has baffled breeders and practitioners for years.*

Without attempting to give a detailed account of findings, suffice it to say that on a number of Experimental Farms (notably at the Central Experimental Farm, Ottawa) where vaccines have been used regularly, careful disinfection made a feature and preventive hygiene followed, according to the best known methods,—this trouble persisted in its appearance. This much is claimed and no more,—in nearly every instance the *disappearance of joint ill cases has coincided with the commencement of administration of small quantities of potassium iodide to the in-foal mare.* No reason so far can be offered. No definite claim for effectiveness is made.

The fall foal rarely, almost never, is afflicted with joint ill probably due to the fact that the mare works all summer, spends much of her time outdoors, and generally enjoys the benefits of a healthy, hard muscled, normal functioning, well scavenged system, all of which is reflected on the foetus. These are undoubtedly the prime requisites to the development of a healthy and therefore resistant (to disease) foal. These, coupled with the use of a clean-breeding stallion (and by this term is meant a horse with no apparent hereditary or genital taints, and with the same constitutional characteristics as mentioned in the case of the mare). No medical treatment will overcome faulty management, but it should be used as an added protection superimposed on practical hygiene.

The suggested treatment is as follows,—for spring-bred mares (the fall-bred mare would not seem to require it), commencing in October or November, give from one-half to a level teaspoonful of potassium iodide crystals in drinking water on the first and fifteenth of each month,—or twice monthly. Simply dilute the crystals or powder in a little warm water and pour into the drinking water. Continue until foaling time. Here it has been suggested to the writer that the quantity may be considerably in excess of requirements, minute though it appears, and that one-quarter teaspoonful is sufficient. On no account should it be increased, therefore. If desired, the same quantities might be administered in weekly instalments and proportionately smaller doses.

Foals from mares so treated, aside from showing no trace of infection, have been singularly rugged and strong. The initial difficulty at Ottawa has been to hold them down long enough to properly disinfect the stump of the navel cord with *tincture of iodine*,—again the old reliable iodine! The stump is not ligatured or tied with tape as sometimes recommended.

Incidentally, it might be stated that the writer is familiar with several practitioners who now employ this method of protection, recommend it, and find it reliable in practice. Reports mostly favourable, come from breeders. Even from Scotland reports have been received stating that disappearance of the trouble in certain Clydesdale studs has coincided with the adoption of the treatment described. Joint ill is much more generally prevalent in Scotland than in Canada.

Let it not be inferred, however, that this treatment is 100 per cent sure. A few cases of joint ill have been noted with iodine treated mares.

* * * *

For Cattle. A consideration of the question as applied to dairy cattle has been left to the last, largely for the reason that less definite information would seem to be available concerning the protective influence of iodine toward certain ailments affecting this class of stock.

This much would appear as well authenticated. Goitre or "bigneck" in calves, frequently a serious condition, may be controlled by the administration of iodine to pregnant cows. With cattle generally, the most practical means of administration is through the medium of salt mixtures. Commercial iodized salt, used regularly, will likely prove satisfactory. Where it is thought necessary to use it during the pregnant period only, and particularly where the treatment is directed toward the control of persistent appearance of goitre in calves,—a home mixture of from 2 to 4 ounces per hundred pounds of salt might prove more reliable. In that some cows consume comparatively small quantities of salt, the method of treatment given under the heading "Swine," in which it will be noted treatment for cows is mentioned, could be used. This method is more certain in application than where iodized salt is used, but less convenient and practical of administration.

Throughout the foregoing it will be seen that iodine would seem to exert a powerful influence for good *during the period of pregnancy.* What protective effect might the administration of iodine have in the case of genital infections of cattle causing premature birth, retained membranes, sterility and other troubles? Much would be given by the writer at this juncture to claim definitely on well-proven grounds that such administration was effective. Such claims have been made, but are not well authenticated as yet. This much would seem quite clear to anyone who has given much study to modern research in the matter of genital disease; no man need expect a rapid return to normal conditions in a herd affected with some form of genital infection (commonly known under the general name of infectious or contagious abortion) simply by the regular administration of iodine to his cows. What might result through the use of this treatment in the way of disease resistance, when applied over a period of time, yet remains to be seen. However, there is one aspect of the question as yet not definitely mentioned, although having a direct and obvious bearing on each consideration taken up in these paragraphs. To illustrate, the following quotation is taken from a recently issued pamphlet as representing a summary of work done in connection with iodine (Iodine for Live Stock, by Frank Ewart Corrie, B.Sc.): "The influence of iodine in establishing and maintaining the *natural powers of resistance has been referred to by many research workers and demonstrated repeatedly in careful laboratory experiments.*" Unquestionably, in the experience of the Central Experimental Farm, lambs, pigs, foals and calves from iodine treated mothers would seem to have increased strength and vitality, and therefore likely increased resistance to disease. Such would seem to explain the effectiveness of the treatment in the case of foals, with reference to an infection in nearly all cases acquired at or immediately following birth. Strong foals are enabled to resist infection.

In the case of genital infection, however, as producing, say, abortion, the infection is acquired pre-natally or at varying periods before birth. To what extent resistance to disease may be effected in the case of the foetus is not clear at present.

The Indirect Effect Possibly Most Important of All.—Research studies have shown that a deficiency of iodine intake has a *direct and certain effect on the assimilation and control of such essential minerals as calcium and phosphorous in the animal body, no matter how abundantly they may be fed.* Such being the case, it would seem well to ensure the proper assimilation of the fundamental mineral requirements of the body by the use of, say, an iodized salt. Particularly is this the case when one considers the quantity of mineral matter in the milk produced by a 20,000 pound cow.

Finally, from indications with dairy cattle and from the knowledge of the general effect of potassium iodide, it would seem like wise practice to utilize an iodized salt during the milking period, and particularly during the period of pregnancy. The commercial variety might be used regularly, or, in cases of specific trouble from goitre in calves, weak calves or genital infections, a home mixed salt as described for sheep might be indicated.

These general conclusions may be set forth:

1. That much remains to be learned concerning the effect of iodine in the feeding of live stock, and in particular with dairy cattle.
2. That the administration of iodine or supplementary mineral matter to live stock *will not rectify poor feeding practice or*

management, generally, particularly during the pregnant period. It should be part of the proper hygienic methods in general.

3. That much remains to be learned concerning quantities fed. Those recommended or suggested are amply sufficient, *should on no account be increased* in preventive treatment, are apparently effective and are likely somewhat in excess. The quantities mentioned in the case of a home mixed iodized salt are stated, therefore, as subject to possible correction.

4. There are in all probability other methods of obtaining the results secured with iodine administration:—more intelligent choice of feeds and the use of mineral supplements, greater appreciation of such factors as winter housing and management, etc., though it is obvious that where there is a natural deficiency of this essential, vital element in the food of stock it must be supplied to them artificially. Pending the results of present and future research, however, the intelligent administration of iodine would now seem to offer a reasonably reliable and relatively inexpensive insurance as discussed in these pages.

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